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ABSTRACT

Models of reading have been proposed to guide researchers and educators in their theoretical research and instructional planning. The models specify important properties of the material to be read and processes the learner uses while reading. Two separate models of reading by K.S. Goodman and D. Rumelhart are similar in that they describe reading as a complex process made up of a large number of skills. The reader uses these skills to accomplish a specific goal: understanding the text. A model of reading expanding these models to text-level variables beyond the boundaries of individual sentences is needed. Discourse analysis considers standard versus scrambled discourse and specifications of the main idea. Four approaches to describing text structure identify relationships among textual units at varying levels of abstraction. A.L. Brown and S.S. Smiley, W. Kintsch, B.J.F. Meyer, and P.W. Thorndyke have complementary approaches to describing text-level variables. Discourse does have a specifiable structure and readers find certain kinds of structures easier to read than others. Although the research in this area is relatively new, there are implications for improved instruction of comprehension based on text structure with emphasis on understanding the main idea of a passage. (MKM)

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# SOME TEXT-LEVEL CONSIDERATIONS

# FOR A MODEL OF READING

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SOME TEXT-LEVEL CONSIDERATIONS FOR A MODEL OF READING

Models of reading have been proposed to guide researchers and and educators in their theoretical research and instructional planning. The models explicitly specify important properties of the material that is to be read and processes the learner uses while reading. The first section briefly compares two reading models, and the second section reviews research on text-level variables that might fruitfully be incorporated in a model of reading. The final section specifies some implications of the research on text-level variables for reading instruction.

## A Model of Reading

Goodman (1967) and Rumelhart (1976) have independently developed remarkably similar models of reading. Both models describe reading as a complex process made up of a large number of skills. The reader uses these skills to accomplish a specific goal: understanding the text. The models require the reader to direct attention to some of the shapes on the page of text, but they emphazise that the reader will not attend to all of the shapes on the page. Rather, the reader will select particular cues from the text based on hypotheses about the message of the text.

The models assume that the text itself has no meaning. The meaning exists in the author's mind, and the author uses the text as a means of communicating ideas to the reader. The reader's task is to understand the author's message that is represented by the text, or, at least, to construct a message from some

elements in the text.*

Both models describe reading as a process of making hypotheses or predictions about the message in a text, selecting cues from the text to test the hypotheses, and then revising the hypotheses based on the information in the text. The models identify many sources of hypotheses including the reader's syntactic knowledge, orthographic knowledge, lexical knowledge, and knowledge of the topic . Both models are rich in identifying kinds of hypotheses that might be made, but they are weak in specifying conditions where a reader is likely to make a particular kind of hypothesis and how the hypotheses are tested. One difference between the models is that Rumelhart proposes that numerous alternative hypotheses are considered simultaneously, while Goodman's model focuses on hypotheses of semantic and syntactic acceptability.

The models implicitly assume that the sentence is the basic unit of analysis, following many linguistic models of language. However, recent work with text-level variables indicates that models of reading should consider properties of the text that go beyond the boundaries of the individual sentences. The next section of this paper reviews research on the organization of discourse. The discussion is divided into three main topics: 1) Standard vs. scrambled discourse; 2) specification of the main idea; and 3) detailed models of discourse structure.

*There is some debate as to whether the reader interprets the text (tries to understand what the author intended to say) or constructs a meaning from the text (tries to come up with ideas that are related to the reader's present knowledge and are compatible with the cues in the text). Spiro (1977) proposes that the reader is able to do either, and that interpreting the text requires primarily syntactic knowledge while constructing meaning from the text requires semantic knowledge. This issue is developed in more detail in the last section of the paper.

## The Structure of text

### Standard versus scrambled text

Aulls (1975), Meyer (1975), and Thorndyke (1977) compared learning from standard paragraphs with learning from paragraphs having some sentences in a random order. All three studies demonstrated that recall is much lower when sentences are ordered randomly that when they are presented in a standard sequence.

The comparison between standard and scrambled paragraphs can be discussed in terms of research on standard versus scrambled word order in a sentence. Miller and Isard (1963), McNeill (1970), and Entwisle and Frasure (1974) all report that subjects are more likely to understand a standard sentence than a scrambled string of words. This finding was interpreted as evidence that the syntax of standard sentences plays an important role in promoting comprehension. By analogy, the finding that standard paragraphs are learned more readily than scrambled paragraphs implies that there are rules for distinguishing well formed paragraphs from sets of sentences. Work on paragraph or text-level rules is just beginning. Some of the models are reviewed later under "Detailed models of discourse structure."

One approach to evaluating the difficulty of a passage is to use a readability formula. The research on the gross distinction between standard and scrambled text identifies one limitation of readability formulas because standard or scrambled passages would have the same readability coefficient. The formulas are not sensitive to differences in passage organization. A study of text level grammars, or rules of organization, should result in additional variables to consider in assessing readability.

Specification of the main idea

One component of the structure of a paragraph that has been investigated is the presence of a statement of the main idea of the paragraph. My college writing text (Perrin and Smith, 1962) provides this description of a paragraph(page 334):

> A paragraph is a unit of the subject larger than a sentence and smaller than the whole paper. Writers group related statements into paragraphs to make the organization of a paper clear to the reader, to help him recognize its major divisions of thought. When effectively organized, each paragraph discusses a slightly different aspect of the subject; yet, while it separates units of thought for reading ease, a good paragraph is smoothly related to the paper as a whole.

Since a paragraph is organized around a specifiable unit of the subject, it should be possible to state that unit explicitly. Several studies have compared how much is learned from a passage when the main idea is stated with how much is learned when the main idea is not stated.

Bransford and Johnson (1972) and Dooling and Mullet (1973) show that when the topic, or main idea, of a passage is presented to the reader recall of the passage is much more extensive than when the main idea is not supplied. The two reports also demonstrate that the main idea must be presented before the passage is read. When readers received the main idea after reading the passage, they recalled no more than a control group that didn't receive the main idea.

In these two studies, passages were carefully constructed so that they would be difficult to understand without additional information. Here is an example of the passages that were used (Bransford and Johnson, 1972):

> If the balloons popped the sound wouldn't be able to carry since everything would be too far away from the correct floor. A closed window would also prevent

> the sound from carrying, since most buildings tend to be well insulated. Since the whole operation depends on a steady flow of electricity, a break in the middle of the wire would also cause problems. Of course, the fellow could shout, but the human voice is not loud enough to carry that far. An additional problem is that a string could break on the instrument. Then there could be no accompaniment to the message. It is clear that the best situation would involve less distance. Then there would be fewer potential problems. With face to face contact, the least number of things could go wrong. (See page 36 for the main idea of this passage)

Individuals studying discourse to guide them in developing textbooks may complain that the passage is artificially ambiguous. Certainly, this example does represent an extreme case. However, the empirical demonstration serves as a vivid reminder to authors that there may be advantages to explicitly stating the topic of an article or the theme of a story.

The results described above have been replicated using standard discourse rather than intentionally ambiguous passages. Thorndyke (1977) used a story about Circle Island (See page 24 for the story.) One experimental group had the theme of the story explicitly stated near the beginning of the paragraph, a second group had the theme stated near the end of the story, and a third group did not receive the theme of the story. Recall was the highest in the first group. Although the group that received the theme at the end of the story recalled more than the group that did not see the theme, this difference was not significant.

Rickards (1975-76) replicates and extends these findings using a more complicated design. He used a passage of 16 paragraphs, each discussing a different aspect of a fictitious African nation. Subjects were presented with two paragraphs at a time. Along with each set of two paragraphs, two groups of subjects received a statement about the main idea of one of the paragraphs (called

the target paragraph). The main idea statement was termed a superordinate statement because the concept named in the statement was conceptually superordinate to the information in the passage. Two other groups received a restatement of a sentence from the target paragraph. This statement was called a coordinate statement because it was on the same conceptual level as the statements in the passage. For each type of statement, one of the groups received the statements before the set of two paragraphs was presented, and the other group received the statements after reading the paragraphs.

Recall of the target paragraphs replicated the results from the studies described previously. A post-hoc analysis of the significant interaction of Type of Statement and Position of Statement showed that superordinate prestatements resulted in more recall than any other condition and that there were no significant differences between the other three conditions.

Rickards also reports recall of concepts and facts from the other paragraph in each set of two (the unrelated paragraph). Although the superordinate concepts of the unrelated paragraphs had not been presented to the subjects, some subjects did report them during recall, indicating that the main idea had been inferred during reading. Rickards found that the group receiving a superordinate pre statement for the target passages was more likely to recall superordinate concepts for the unrelated passages, and that there was no difference in the recall of superordinate unrelated concepts in the other three groups. Even though one group recalled more concepts from the unrelated paragraph, this was not accompanied by increased recall of facts from the unrelated paragraph.

In summary, Rickards demonstrated that providing a statement

of the main idea of some paragraphs in a longer text has two effects:

1. The recall of facts related to the explicitly stated main idea is increased, and
2. The reader is more likely to infer a main idea for those paragraphs where a main idea is not explicitly stated, but recall of the inferred main idea is not accompanied by increased recall of related facts.

Rickards also used an interesting measure of the effectiveness of a superordinate concept, or explicitly stated main ideas. He computed the average number of facts that were recalled for each recalled concept and found that concepts presented before reading a paragraph resulted in more related facts being recalled than concepts presented after reading the paragraph. This comparison was not made between concepts that were provided and concepts that were inferred. Would the source of the concept be related to the amount recalled?

Christie and Schumacher (1976) provide some suggestion that what is recalled is a function of whether the main idea is stated or inferred. Christie and Schumacher used a strange "paragraph" for their study. Half of the sentences in the paragraph were related to the theme of watching a parade, but the other half was unrelated to the theme. The experimental group was given a statement about the theme of the passage prior to reading it, and the control group read only the passage. In contrast to earlier studies, there was no difference between groups in the total amount recalled.

The subjects in the control group were asked about the passage after they finished the recall task. They reported that the paragraph was about a parade, and many of them stated

that they had figured out the theme by the fourth sentence of the passage. The recall protocols of the experimental and control groups were examined in more detail. Recall of sentences related to the theme was compared with recall of sentences unrelated to the theme. Ther control group that generated the theme recalled more related sentences than unrelated sentences, but there was only a small difference in recall for these two types of sentences for the experimental group supplied with the theme.

The results fit in very nicely with the models of reading developed earlier. The models assume that reading is a goal directed process, with a goal of understanding the text. Thorndyke (1977) specifies a goal more precisely by proposing that reading is directed toward identifying a main idea for a passage. The results of Rickards and Christie and Schumacher show that readers can infer the main idea if it is not provided. If the text is somewhat ambiguous, like the parade passage with half of the sentences unrelated to the theme, the readers especially attend to parts of the passage that support they hypothesis under consideration. If readers are supplied with the main idea, they can attend to how the individual statements contribute to the main idea. More extensive recall would be expected from passages where the main idea was supplied than from passages where it was inferred. Although Christie and Schumacher's results do not support this expectation, this may have resulted from the unusual passage they developed for their study. The results do show that the experimental group recalled more "unrelated" sentences than the control group. Perhaps readers who were given the theme were able to relate some of the "unrelated" sentences.

This description of a reading model assumes that the reader does not work on several aspects of the passage simultaneously.

The model is assumed to have a limited processing capacity which is directed first to developing and confirming hypotheses about the main idea and then to relating the individual sentences to the main idea. If the reader must develop possible candidates for the main idea, he will not be able to attend to the relationships of individual sentences to the main idea. Rickards finding that students generated concepts for unrelated passages but they didn't consequently remember more unrelated facts fits in nicely with the limited processing notion and the priority of the goal of identifying the main idea.

One more study will be mentioned in this section, because it suggests that the structure of the passage cannot be considered independently of the content of the passage. Aulls (1975) failed to find a significant main effect for explicitly stating the main idea, but statistical tests for this factor were confounded in a complex factorial design. Aulls used two different passages: one described how tecnnological developments have made housekeeping easier (labeled High Meaningful) and the other explained how the pupil of the eye worked (labeled Low Meaningful). Subjects read either a standard or scrambled passage accompanied by the presence or absence of a title and/or a statement of the main idea. For the High Meaningful passage, manipulating the title and main idea statement did affect recall, but for the Low Meaningful passagge there was no effect for this factor. This result is important because it indicates that the effects of passage structure may be moderated by aspects of content. Exactly how this content-related variable of Meaningfulness should be defined can not be determined from Aulls work, but it will be considered in more detail in the last section of this paper.

Future research on the role of the main idea could profitably investigate questions derived from the results reviewed in this section. The questions are summarized here:

1. Does explicit statement of the main idea or theme of a passage promote comprehension? Most of the studies reviewed here indicate this should be answered "Yes", but the literature could use more demonstrations of this effect with standard passages that are typical of instructional materials. Many of the passages that have been used in this research have contrived features for laboratory investigations, so there is some question whether the results are generalizable to most instructional materials.

2. What characteristics differentiate passages that provide the reader with sufficient information to infer the main idea from passages where the reader is unable to infer the main idea? Bransford and Johnson (1972) have developed passages where the main idea is usually not inferred by the subjects, but subjects had no difficulty inferring the main idea of the parade passage. The structural differences between these paragraphs should be explicitly described and investigated to identify variables that increase the probability that the reader will infer the main idea.

3. What processes are used by the reader to infer the main idea of the passage? Research on this question complements studies of question 2. This question emphasizes internal, cognitive processes that develop hypotheses based on information in the text and check these hypotheses against additional cues from the text, and question 2 identifies text characteristics that make it more likely the reader can develop and check hypotheses. This question also involves identifying any prerequisites to the skill of identifying the main idea. For example, Rickards main idea statement specified

a concept superordinate to the facts in the passage. Perhaps the ability to identify a superordinate concept when given several examples is a necessary prerequisite to the skill of inferring the main idea.

4. Do readers use different processes when the main idea is explicitly stated than when it must be inferred? I have suggested that when readers are given the main idea of a passage, they can focus on how the details in the passage support the main idea, but when the main idea must be inferred, less attention can be given to the types of relationships that exist between the main idea and the other propositions in the passage. Studies of this question develops the levels of processing notion advanced by Craik and Lockhart (1972), specifying that one level of processing is identifying the main idea and that a "deeper", or subsequent level is relating individual propositions to the main idea.

This section has reviewed research on the explicit statement of the main idea of the passage as one component of the structure of the passage. The next section describes more extensive descriptions of the structure of discourse. These more complex models do provide very complicated models for the structure of discourse, but most of them do not treated the question of whether the relationships are explicitly stated or must be inferred by the reader.

Detailed models of discourse structure

All of the models that are described in this section describe discourse as consisting of propositions that are hierarchically interrelated, with some sentences (or the propositions they represent) of major importance in the text, others of minimal

importance, and others at many intermediate levels of importance. Many of the models represent the structure of a text by a branching tree structure to illustrate superordinate and subordinate relationships between textual elements.

Earlier in this paper passages were described as consisting of main ideas and supporting facts. This dichotomy can be represented by a simple hierarchy, with the main idea at the top, and the supporting facts at the second level. The models reviewed in the following paragraphs assume that some of the supporting facts are directly related to the main idea, while others primarily extend or clarify one of the supporting facts. Consequently, a passage might be represented by a tree structure with elements at many different levels.

Numerous models have been proposed to describe the structure of a paragraph. Four models representing different approaches will be described, including 1) a statistical approach (Johnson, 1970; Brown and Smiley, 1977a,b), 2) a density approach (Kintsch, 1976), 3) a case-grammar approach (Meyer, 1975,a,b; 1977), and 4) a text grammar approach (Thorndyke, 1977; Mandler and Johnson, 1977)

Before describing the details of each approach, findings common to all approaches will be described. All models use the proposition as a basic unit of discourse. The proposition is a meaning unit, similar to Chomsky's notion of a kernel sentence. The propositions of a text are expressed in the sentences of the text, however, one sentence may include several propositions, or, for some models, a proposition may span several sentences.

Research with these models has consistently demonstrated that readers are most likely to recall propositions that are superordinate to the other propositions or considered to be the most important in the passage. In addition, the probability

of recalling a proposition is a decreasing function of the distance between that proposition and the most central or important propositions in the passage. This effect is evident even when the same statements are embedded in two different texts, with the statements at high levels of the discourse structure in one text and at low levels of the structure in the other text. The relationship between probability of recall and position in the structure of a passage has been repeatedly demonstrated and seems generalizable across many different texts.

Basic approaches to discourse structure are reviewed in the following paragraphs to identify details of the relationship between structure and comprehension.

A statistical approach

Brown and Smiley (1977a,b) used a technique developed by Johnson (1970). College students divided a story into units by placing a vertical line at a division point. Units were defined as sentences or parts of sentences that contained an idea or represented a place where a reader might pause. After the units were identified, another group of students rated the importance of each unit to the theme of the story using a four point scale. First the least important 25% of the units was crossed out. This procedure was repeated twice, leaving the most important 25% of the units. This statistical procedure identified units at four levels of importance within the story. Why a unit was rated at a particular level of importance is not investigated by Brown and Smiley, although this is a possible extension of the technique. The important point is that college students are able to agree with each other in their identification and ratings of text units, supporting the claim that text is

hierarchically structured.

After the units of the story were rated, the stories were presented to readers of various ages to read and recall. Subjects from kindergarten (Smiley, Oakley, Worthen, Campione, and Brown, 1977) through college recalled units as a function of their rated importance. Older students recalled more than younger students, but there was no interaction of age and importance level.

Although readers of all ages are more likely to recall textual units that were rated most important, younger readers were unable to explicitly identify the most important units. While college students could reliably separate text into four levels of importance, seventh graders could distinguish only high, medium, and low levels, fifth graders only separated the most important units from the others, and third graders were not able to reliably identify the most important units (Brown and Smiley, 1977b). In other words, young readers are likely to recall the most important units of the text, but they cannot explicitly identify the most important units before fifth grade. Children tacitly use skills of identifying the relative importance of textual units before they can explicitly use these skills.

The advantage of the statistical approach to identifying paragraph structure is that it is a simple, objectively-based procedure. Limitations to this approach may lie in the extent to which it is generalizable to other stories and passages. The stories used in these studies were relatively short. Judgements of relative importance of idea units may be less reliable in longer, more complex passages.

A density approach

Kintsch proposed a structure for semantic memory (Kintsch, 1974;1976). In many of his studies, the content of semantic memory is derived from a passage, so the structure may also be applied to the structure of a passage. Kintsch's model is a psychological model, describing the processes used in understanding text. This is investigated by presenting the reader with different types of text and examining how the text characteristics are related to the reader's performance. Including Kintsch's work in this paper is really re-interpreting Kintsch's investigations focusing on the text, rather than on the reader.

Kintsch identifies two aspects of text: the number of propositions in the text, and the number of lexical items, or arguments, in the propositions. A proposition consists of a relation and one or more arguments and serves as the basic unit of his model. The structure of text is determined by embedding on proposition within another, that is, an entire proposition may serve at an argument. The subordination relationship for Kintsch is often signalled in the surface structure through syntactic devices such as dependent clauses. Subordination is also indicated by order, since any proposition containing a particular term is considered to be subordinate to any preceding proposition that also contains this term.

I have called Kintsch's model a density model because the studies reviewed below varied the number of different arguments or the number of propositions in a passage while the number of words remained constant. Subjects read a passage and then indicated when they were ready to recall it. The time spent reading was used as an index of the difficulty of the passage.

Kintsch and Keenan (1973) kept the number of words constant, but varied the number of propositions in a paragraph. As the number of propositions increased, the reading time inceased. In other words, a twenty word passage with eight propositions took longer to read than a twenty word passage with four propsitions. This result indicates that text may vary in how compactly the underlying ideas are expressed, and that when many propositions are embedded in a few words, the text is relatively difficult.

Kintsch, Kozminsky, Streby, McKoon and Keenan (1975) compared reading times for texts with the same number of propositions but with various numbers of different arguments. They report that the reading time increased as the number of different arguments increased. Another index of text difficulty seems to be the number of different concepts that are included in the text.

Considerations of the density of ideas are usually not included in readability formulas, except to the extent that sentence length represents the number of different embedded propositions and the number of different referenced concepts. Kintch's work suggests that a more explicit treatment of these two aspects of text would be a useful addition to readability formulas.

Kintsch, Kozminsky, Streby, McKoon and Keenan (1975) used two different types of passages in their investigation. They used passages from a history book written for children and descriptions of science concepts. When the reading time for history passages was compared to the reading time for science passages with the same number of propositions and the same number of different arguments, the authors note that the science passages took much longer to read. The authors propose that

the history content was more familiar than the science content, but this is a description of the content, rather than an explanation of the results. The finding is important, however, because it indicates that content must be considered along with structure in assessing the difficulty of written materials.

A Case-grammar approach

Meyer (1975a, b; 1977) uses a hierarchically arranged tree structure to describe passage structure. Nodes contain content words, and connecting lines are labeled to identify relationships among the content. A passage is considered to be a complex proposition that is decomposed into subpropositions that are related in specifiable ways. Propositions are composed of a predicate and its arguments, similar to Kintsch's model. Not all predicates are explicitly stated in the text. The model includes lexical predicates and rhetorical predicates. Rhetorical predicates are of interest here, because they typically represent intersentential and interparagraph relationships and define the higher levels of content structure. The types of rhetorical predicates are listed in Table I. Arguments of paratactic predicates are at the same level in the content structure, while hypotactic predicates have one argument subordinate to the other. Arguments of neutral predicates may be subordinated or coordinated.

Meyer's system not only ranks propositions in a hierarchy, but indicates which propositions are superordinate to particular propositions. By analyzing patterns of recall protocols, Meyer found that if a particular proposition is recalled, the unit directly above the proposition is recalled nearly 70% of the time, compared to an overall probability of recall of .25)

Table 1

Rhetorical Predicates from Meyer, 1975b, p. 33

| Paratactic Predicates | Description |
|---|---|
| Alternative | Equal weighted alternative options |
| Response | Equal weighted Question(s) and Answer(s), Remark and Reply, or Problem(s) and Solution(s) |
| **Hypotactic Predicates** | |
| Attribution | Describes qualities of a proposition |
| Equivalent | Restates same information in a different way |
| Specific | Gives more specific information about something that was stated in a general manner |
| Explanation | Previously stated information is explained in a more abstract manner (for example: relating the information to a general principle) or a more concrete manner |
| Evidence | Evidence through perception of a situation to support some idea |
| Analogy | Analogy given to support an idea |
| Manner | Way an event or event comples is performed (examples: slowly, carefully) |
| Adversative | Relates what did not happen to what did happen |
| Setting time | Gives time of setting in which information being related occurs |
| Setting location | Gives location of setting in which information being related occurs |
| Setting trajectory | Gives changing background of location and time that occurs in a narrative when characters travel through various places |
| Representative Identification | Singles out one element of a group and makes it stand for the group as a whole |
| Replacement Identification | One thing stands for something else |
| Constituency Identification | Identifies a part in relation to some whole |
| **Neutral Predicates** | |
| Collection | List of elements related in some unspecified manner |
| Covariance | Relation often referred to as condition, result, or purpose with one argument serving as the Antecedent and the other as the Consequent or result of the antecedent |

Meyer's research also provides some information about an important question that has been ignored so far in this paper. Most of the studies reported here have used passage recall to measure comprehension. There is the possibility that the content that is recalled is a function of retrieval processes rather than of processes used while reading the text. Meyer describes the alternative hypotheses (1977, p. 186):

> It may be that the content structure guides the reader's attentional processes, causing him to be more likely to select for storage that information high in the passage structure. On the other hand, it may be that high and low information are equally stored, but that the laws of retrieval are such that high information is more likely to be recalled under free recall conditions.

To examine these alternative hypotheses, Meyer used a cued recall test to compare learning of high and low structural positions. Providing a recall cue should minimize effects due to retrieval. In order to control for the content, the same target paragraph was embedded in two different passages. In one passage, the information in the target passage was at the top of the content structure and in the other passage it was at the lowest levels of structure. Cued recall was significantly higher when the paragraph was at the top of the content structure, and there was no interaction of level in hierarchy and type of test. This finding supports the claim that recall protocols reflect processes used during reading rather than processes unique to retrieval.

Meyer uses lengthy, complex passages in her research. A 641-word passage entitled "Parakeets: Ideal Pets" had seventeen levels in its content structure. Meyer developed fifteen questions from the top eight levels of the structure, and fifteen questions from levels 10 - 17 to measure learning from the paragraph. Meyer notes that "questions from levels one

through eight in the structure correspond to questions educators have called questions asking for main ideas, and those from levels 10 to 17 correspond to questions asking for details." Sixth grade students were more likely to answer the high level questions correctly than the low level questions.

This study is important in three different ways. First, it entends the finding that readers tend to remember the high level information better than lower level information from college students to sixth graders. Second, it illustrates how Meyer's analysis technique can be used to generate questions about prose. Third, it reminds us that readers will not remember everything from a passage.

Meyer also studied recall of high and low level information as a function of reading level. All students were in sixth grade, but one group as reading 1½ years above grade level, a second group was reading three months below grade level, and the third group was reading a year below grade level. The main effect for reading level was significant, as was the main effect for structural level, but there was no interaction. This seems to suggest that readers at all levels are sensitive to the relative importance of ideas in a text, but that relatively less-skilled readers understand less of the passage over-all.

Another question Meyer investigated was whether the probability of recall was chiefly a function of level in the hierarchy, or whether it was more closely related to the types of relationships among propositions at high levels in the content structure. She compared recall from two passages with the same structure but different content and found that most of the recall could be explained by the specific types of relationships in the structure rather than simply to the level of the proposition in the passage

hierarchy. Although top-level information is much better remembered that low-level information, not all top-level information is equally well remembered. The particular information that is remembered is a function of the types of relationships that exist between the top level units.

To demonstrate that some top-level relationships result in more recall than others, meyer used two different types of top level structures with the same 58 units defining the lower levels of a paragraph's structure. One passage had five units in a rhetorical predicate of covariance, and the other passage had five units representing a rhetorical predicate of attribution. When recall of the 58 units common to both passages was compared, more information was recalled with the covariance structure, demonstrating that a particular top level structure facilitates comprehension more than another.

Meyer's approach to describing prose structure has resulted in a very rich set of conclusions about the relationship between the structure of a passage and comprehension of a passage. This type of approach should prove very fruitful in preparing materials that are optimally structured to increase the probability that the reader will understand the author's message.

There is little evidence for the adequacy of the particular types of predication Meyer's identifies. Some research is needed to establish the particular types of relationships that most adequately describe intersentential and interpassage relationships. Then readers of various ages should be studied to see whether the relationships are used by readers of all ages, or whether one aspect of development is to understand an increasingly diverse set of rhetorical predicates.

A text-grammar approach

Another approach to describing the structure of a passage is to identify particular types of text and then to specify how adequately a text represents a particular type. This approach has been used most extensively with stories (Bower, 1976; Mandler and Johnson, 1977; Rumelhart, 1975; and Thorndyke, 1977). Thorndyke's model is described in detail to illustrate the kinds of questions that have been investigated with this approach.

Thorndyke's description of a story is analogous to phrase-structure models in a sentence grammar. Table 2 presents the rules of his grammar for simple stories. The first rule specifies the four major components of a story and describes the top level of a story hierarchy. The subsequent rules indicate how each of the components may be rewritten. Each application of a rewrite rule adds additional levels to the story hierarchy. Thorndyke does not analyze the content of individual propositions, but rather focuses on common features of narrative text organization.

Thorndyke proposed that readers used the grammatical rules in Table 2 to understand a story. If a text were written so it did not match the reader's expectations derived from the grammatical rules, the reader would have difficulty understanding the story. To test this hypothesis, Thorndyke used three different forms of the Circle Island story and the Old Farmer stroy (Presented in Table 3). One group read the standard story, a second group read the story with the theme moved to the end of the story, and a third group read the story without the sentences stating the theme. As Thorndyke predicted, recall was a function of the extent to which the text conformed to the ideal story structure. The group reading the standard structure recalled the most.

Thorndyke also examined whether recall was a function of

| Rule Number | Rule |
|---|---|
| 1 | STORY → SETTING + THEME + PLOT + RESOLUTION |
| 2 | SETTING → CHARACTERS + LOCATION + TIME |
| 3 | THEME → (EVENT)* + GOAL |
| 4 | PLOT → EPISODE* |
| 5 | EPISODE → SUBGOAL + ATTEMPT* + OUTCOME |
| 6 | ATTEMPT → {EVENT* / EPISODE} |
| 7 | OUTCOME → {EVENT* / STATE} |
| 8 | RESOLUTION → {EVENT / STATE} |
| 9 | {SUBGOAL / GOAL} → DESIRED STATE |
| 10 | {CHARACTERS / LOCATION / TIME} → STATE |

Table 2

Grammar rules for simple stories (Thorndyke, 1977, p. 79)
Elements in parentheses are optional; elements followed by an asterisk may be repeated.

# Table 3

Stories used by Thorndyke, 1977

## The Circle Island Story

(1) Circle Island is located in the middle of the Atlantic Ocean, (2) north of Ronald Island. (3) The main occupations on the island are farming and ranching. (4) Circle Island has good soil, (5) but few rivers and (6) hence a shortage of water. (7) The island is run democratically. (8) All issues are decided by a majority vote of the islanders. (9) The governing body is a senate, (10) whose job is to carry out the will of the majority. (11) Recently, an island scientist discovered a cheap method (12) of converting salt water into fresh water. (13) As a result, the island farmers wanted (14) to build a canal across the island, (15) so that they could use water from the canal (16) to cultivate the island's central region. (17) Therefore, the farmers formed a procanal association (18) and persuaded a few senators (19) to join. (20) The procanal association brought the construction idea to a vote. (21) All the islanders voted. (22) The majority voted in favor of construction. (23) The senate, however, decided that (24) the farmers' proposed canal was ecologically unsound. (25) The senators agreed (26) to build a smaller canal (27) that was 2 feet wide and 1 foot deep. (28) After starting construction on the smaller canal, (29) the islanders discovered that (30) no water would flow into it. (31) Thus the project was abandoned. (32) The farmers were angry (33) because of the failure of the canal project. (34) Civil war appeared inevitable.

## The Old Farmer and His Stubborn Animals

(1) There once was an old farmer (2) who owned a very stubborn donkey. (3) One evening the farmer was trying to put his donkey into its shed. (4)First, the farmer pulled the donkey, (5) but the donkey wouldn't move. (6) Then the farmer pushed the donkey, (7) but still the donkey wouldn't move. (8) Finally, the farmer asked the dog (9) to bark loudly at the donkey (10) and thereby frighten him into the shed. (11) But the dog refused. (12) So then, the farmer asked the cat (13) to scratch the dog (14) so the dog would bark loudly (15) and thereby frighten the donkey into the shed. (16) But the cat replied, " I would gladly scratch the dog (17) if only you would get me some milk." (18) So the farmer went to his cow (19) and asked for some milk (20) to give to the cat. (21) But the cow replied, "(22) I would gladly give you some milk (23) if only you would give me some hay." (24) Thus, the farmer went to the haystack (25) and got some hay. (26) As soon as he gave the hay to the cow, (27) the cow gave the farmer some milk. (28) Then the farmer went to the cat (29) and gave the milk to the cat.(30) As soon as the cat got the milk, (31) it began to scratch the dog. (32) As soon as the cat scratched the dog, (33) the dog began to bark loudly. (34) The barking so frightened the donkey (35) that it jumped immediately into its shed.

position in the hierarchy of the story. Recall was related to hierarchical position for the group that read the standard stories, it was less related in the group that had the theme at the end of the passage, and it was unrelated in the group that didn't receive the theme. A very small change in the text had extensive consequences for how much and what was recalled.

Thorndyke also found that subjects reading the standard story recalled information in the order it appeared in the story, but the group that read the theme at the end of the story tended to recall it at the beginning. Readers were likely to restructure the story when they had all the component parts.

Mandler and Johnson (1977) developed a grammar for fables that is similar to Thorndyke's story grammar, but they make two important additions to the general description of story structure. First, they specify that episodes may be connected causally or temporally. They propose that cuasally related episodes will be recalled better than temporally related ones because "the rewrite rule for EPISODE unites causally connected episodes into single large episodes, whereas temporally connected episodes remain separate." (page 133) This explanation is simply a restatement of the relationship, but attempts to specify kinds of relationships within a story are to be encouraged. Meyer's rhetorical predicates could suggest relationships to be investigated.

Second, Mandler and Johnson examine whether the same grammar is used by readers at different ages. They presented stories to first graders, fourth graders, and college students and found that the model applied equally well to all groups, indicating that even first graders used an identifiable grammar to understand stories. Subjects at all ages rarely reordered the

basic nodes of the story during recall.

Thorndyke (1977) also examined how differences in story structure were related to recall. Both the Circle Island Story and the Old Farmer story are well-formed stories according to Thorndyke's grammar, but they have very different structures (See Figures 1 and 2). In the first experiment, Thorndyke noted that subjects tended to recall more of the Old Farmer story, but whether this was due to the structure of the content of the story could not be determined since the two were confounded.

To directly study the relative roles of structure and content, two new stories were written. One had the structure of the Old Farmer story but the content of the Circle Island story, and the other had the content of the Circle Island story but the structure of the Old Farmer story (see Table 4). Stories with the Old Farmer story's structure were recall more extensively. Most of this structure consists of a set of causally embedded events. Thorndyke does not indicate which parts of the story are recalled, but Mandler and Johnson's work suggests that the causal relationship among these events may be the locus of the facilitation.

Thorndyke also found that the story content had a significant effect on comprehension. Stories having the Old Farmer content were recalled better than those with the Circle Island content. There was no interaction between structure and content, suggesting that the effects of structure and content are independent.

The approach of identifying types of text will be useful if a sufficiently small number of types can be identified. Thorndyke's model describes only a small set of single-goal, single-protagonist narratives. Mandler and Johnson found it

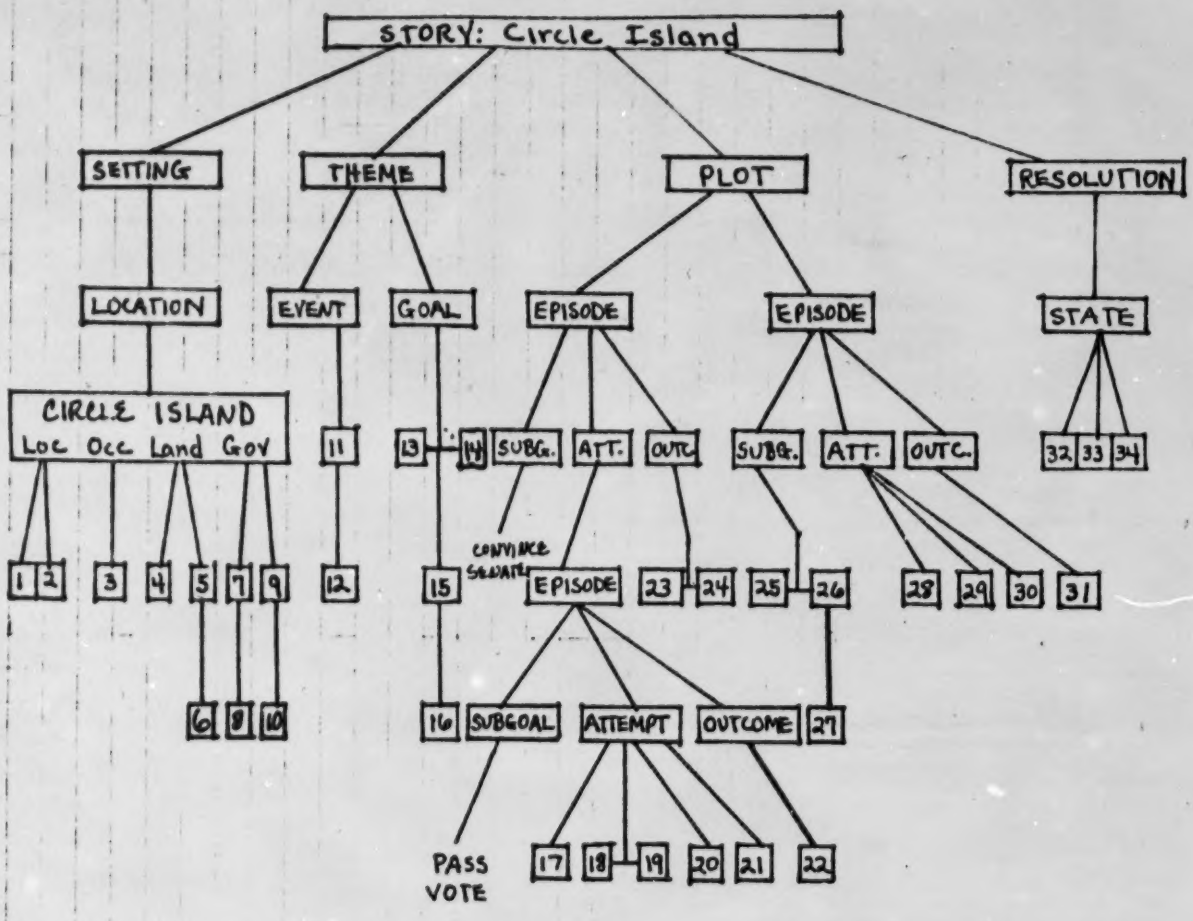



Figure 1

Plot structure for the Circle Island story. Numbers refer to sentence position in story. (Thorndyke, 1977, p. 81)

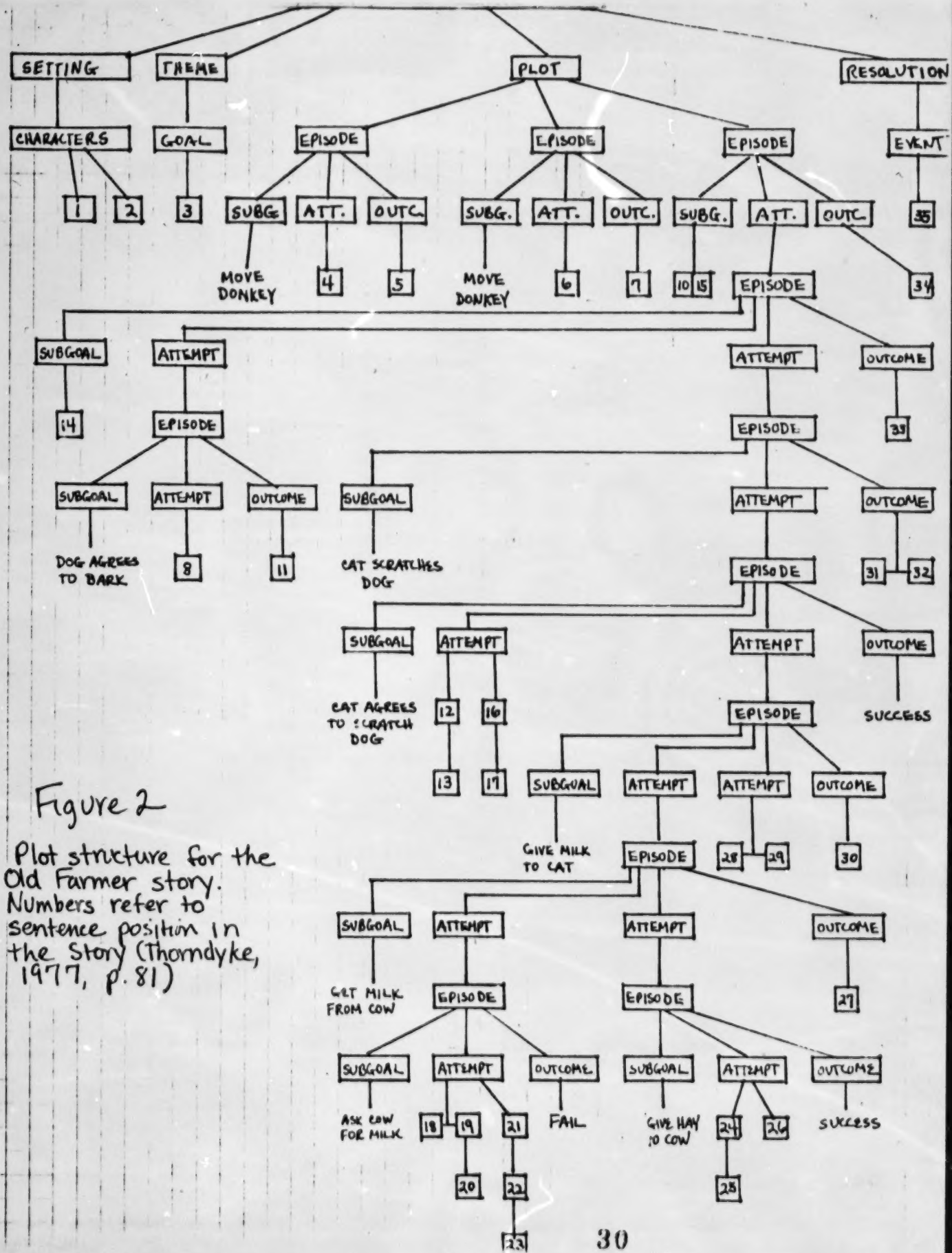



Figure 2

Plot structure for the Old Farmer story. Numbers refer to sentence position in the story (Thorndyke, 1977, p. 81)

# Table 4

More Stories used by Thorndyke, 1977

Circle Island Structure; Old Farmer Content

Large dairy farms are located throughout Fleetwood County. Unfortunately, all the farmers in the county are very poor, so their farms are small and usually in great need of repair. One old farmer owned several animals who all lived together in a communal barn. The old farmer cared for his animals and always tried to make their lives on the farm enjoyable. The animals organized themselves into a voting democracy and resolved barnyard issues by a majority vote. One day the farmer's cow discovered a bag of gold coins hidden beneath a clover patch. So some of the animals decided among themselves that they wanted to build a new barn, since the old one was nearly useless. So these animals formed a planning committee and persuaded some other animals that the money should be spent to rebuild. A referendum was held on the issue, and all the animals voted. All of the animals voted in favor of the new barn. The farmer decided that the taxes on a new barn would be too high. The farmer agreed instead to mak improvements to the old barn. After remodeling of the old barn was completed, a fire destroyed the entire barn. The farmer would not rebuild again, and the animals were left homeless. The animals were angry because the farmer was such a miser. In retaliation, they burned down his house.

Old Farmer Structure; Circle Island Content

Circle Island is governed by a constitutional democracy. The two major political parties are the Populists and the Federalists. Last spring the Federalists promoted a senate bill for the installation of an island-wide communications network to be used in weather prediction. The Federalists petitioned the senate, but the senate would not pass the bill. So the Federalists asked the Populists to join forces in support of the bill and thereby pressure the senate into action. The Populists, however, declined the proposal. Then the Federalists asked the island's independent weathermen's union to announce support of the bill so that Populists would join the Federalists' fight and thereby win passage of the bill in the senate. The union agreed to support the Federalists only if the usefulness of the project could be demonstrated to them. So the Federalists made a plea to a prominent scientist to testify to the technical advantages of the communications network. But the scientist declined to testify until research on the signal transmission properties of the system could be conducted. Thus the Federalists funded scientific research which resulted in proof of the efficiency of the system. As soon as the results were released, the scientist agreed to testify. The scientist testified before the union in support of the installation project. The union was thus convinced and publicly announced their backing of the Federalists. As a result of the union's announced support for the plan, the Populists joined the Federalists to fight for passage of the bill. The support for the bill was so overwhelming that the senate immediately passed it and signed it into law.

necessary to develop a different grammar for fables. Perhaps the diversity of models and limited scope of each model simply represents the efforts of pioneers to identify a managable starting place to develop text grammars. Whether more powerful grammars will be developed, incorporating these grammars of rather limited scope remains to be seen.

The future of detailed models of discourse structure

The four approaches to describing text structure identify relationships among textual units at varying levels of abstraction. Brown identifies the relative importance of textual units, but does not specify the basis for the importance ratings; Kintsch chiefly uses explicit textual references to specify embeddings; Meyer uses a set of rhetorical predicates to describe types of relationships between textual units; and Thorndyke compares individual passages to a general description of a text-type. These approaches seem complementary rather than contradictory.

Kintsch's approach and Meyer's approach seem especially useful because they can be used to describe how two standard texts differ, and how these differences are related to how readily the text is understood. In contrast, Thorndyke's model, at it's present level of development, cannot predict which of two different grammatically acceptable story structures will be easier to recall. In order to be a useful model, Thorndyke's story grammars should be expanded to account for differences between various acceptable story structures.

Research with these models repeatedly demonstrates that propositions low in the hierarchy are not included in recall. It is interesting to speculate on the role of subordinate information. Does the reader scan a paragraph to identify

the main ideas and essentially ignore the rest of the passage, or are the subordinate ideas used in constructing and particularizing the representation of the main idea? Thow subordinate ideas are used by the readerwould be a necessary component of any model of the reading process.

Research on comprehension of sentences has used two different developmental trends in the methods: presenting various syntactical forms to individuals of different ages, and collecting samples of sentences produced by speakers of different ages. Research reviewed in this section has used the first method exclusively. It may be fruitful to study text (or discourse) produced by individuals to identify developmental changes in mastering the structure of discourse. For example, a study by Botvin and Sutton-Smith (1977) identified structures that characterize stories that children produce. The basic story structure is a simple dyad including a specific motivation for action and a resolution. This structure is first evident in stories of four and five year olds. Then children add details and other elaborations to this nuclear dyad, introducing secondary plot units. At age 7, children's stories typically consist of several nuclear dyads in succession with only minimal elaboration of the individual dyads. Then children coordinate the different dyads and expand each individual dyad. By age 11 or 12 children produce narratives with embedded structures, developing subplots within the main story. This identifiable sequence in children's production of stories might be used to suggest the structures children at various ages would read most readily.

Several studies included a study of content as well as structure. Exactly how content and structure are related will be a central question for researchers. It is interesting that the studies reviewed here did not report an interaction of

structure and content. In other words, some structures resulted in higher recall or faster reading time than others, and some content resulted in higher recall or faster reading time than others, but some content was not especially facilitated by some structures. However, the designs explicitly investigating possible interactions of structure and content have not been used exclusively, so the generalizability of the findings is not known.

Research using detailed moseld os discourse structure does demonstrate that readers are sensitive to relationships among parts of the text and the readers find some types of text easier to understand than others. The work that has been done so far demonstrates types of models that may be useful, but the adequacy of the details of the models have not been specifically examined. The field will be more satisfactory when the research community compares alternative models to decide which is the most adequate in identifying psychologically important aspects of text structure.

## Implications for reading instruction

Research on text-level variables is a recent development. Researchers have only developed preliminary models to describe the structure of a text. Given the state-of-the-art, it seems premature to specify implications based on a detailed model of discourse structure. However, some general suggestions seem justifiable.

Discourse does have a specifiable structure, and readers find certain kinds of structure easier to use than others. While reading, expectations or predictions are made on the basis of structural considerations, and comprehension is facilitated when the actual structure matches the predicted

structure. The details of how individuals learn the structure of text is not known, just as it is not known in detail how children learn the syntax of sentences. There seem to be two conditions necessary for the acquisition of syntax. The child must be able to perceive examples of syntactically acceptable sentences, and many of these sentences must be specifically designed to communicate with the particular child. Models of speech are not sufficient, since children of deaf parents do not learn language from radio or TV (Ervin-Tripp, 1973). Cazden (1965) demonstrated that children in a "modeling" condition had devloped greater language skills than children in an expansion group or in a control group. Several authors have tried to explain why the expansion treatment was not more successful (See Dale, 1976, p. 149 - 152), but another explanation is possible. The "modeling" condition required the teacher to make a comment that was related to the child's comment; the teacher extended the meaning of the child's utternace in a syntactically acceptable way. In contrast, the "expansion" group simply heard their statements repeated in a more complex syntactical form. The teacher's comment would not communicate any new ideas to the child. The condition that was most facilitative of language development provided the most opportunities for the child to communicate with the teacher and for the teacher to reply to the child. This condition seems to promote language development. Chomsky (1972) also found that children who are read to frequently and who discuss books with their parents are likely to read earlier than children with little experience with books. It seems plausible that one consequence of listening to and discussing books would be knowledge of how books and stories tend to be structured. Experience with

discourse may be instrumental in developing a knowledge base for making predictions about the structure of a text.

One consequence of this line of reasoning is that children should be exposed to many examples of text. When the child cannot read the text alone, it can be read by an adult. Examples of many different types of text should be used, so the child can develop a broad understanding of types of text. Stories, descriptions, instructions, and expository selections should be included in a reading program. It is probably not sufficient for children to listen to these texts, however. Discussion of the main theme of the text is probably a necessary condition for acquiring knowledge about the structure of text.

The finding that some portions of a text are more important than others has implications for the questions children are asked about a text. Rothkopf and Bisbicos (1966) demonstrated that the type of questions that are asked after a text is read function to direct the reader's attention to particular aspects of the text. If readers are repeatedly questioned about relatively unimportant portions of the text, they may adapt by concentrating on the minor points of the passage and by ignoring the main idea. It is recommended that teachers limit comprehension questions to the main idea, to provide practice in this essential skill. If details are of interest, it seems most appropriate to ask about how the detail support the main idea rather than to focus the reader's attention on the detail itself.

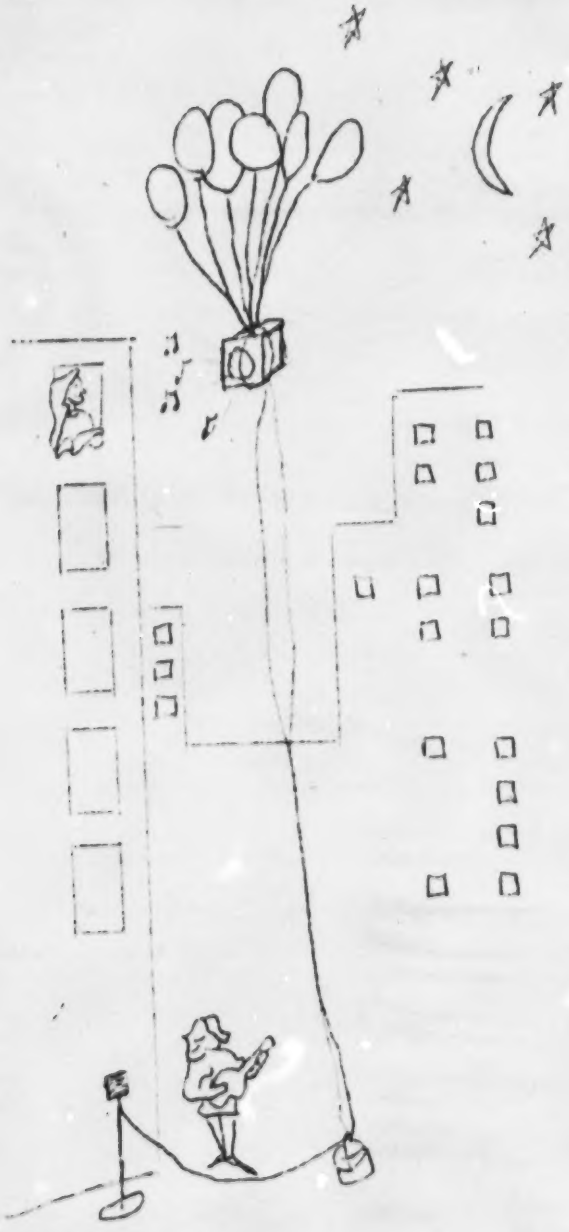
Brown and Smiley's work is also important in suggesting kinds of questions teachers might ask. Children younger than fifth grade would very likely have difficulty answering "What is the main idea of the story?" Rather, children can be

successful at tasks that require implicit use of the skill of identifying the main idea. Experiences with retelling a story, for example, seem more appropriate for young readers than a structural analysis of a passage.

Cunningham (1978) presents an example of explicitly teaching a story grammar to fourth graders, and then having them diagram various stories. He dose not provide data indicating whether the children were able to use these structures. Also, I was disappointed in his article because it did not explain why such an exercise should be included in the curriculum.

Although the descriptions of text that have been developed are not sufficiently explicit to rank paragraphs from simple to complex, they do describe properties of a well-formed passage. Beginning reading materials might be explicitly designed to be well-formed, in order to capitalize on the readers knowledge of text structure in reading. Advanced readers might be taught that some text is not well structured, so if they experience problems with understanding the text they recognize that the text may be at fault. Older readers could be taught strategies for coping with ill-formed text, but beginning readers should not have their initial reading attempts unnecessarily disrupted by poorly formed text.

Reading programs have many exercises for students to practice orthographic and phonological skills. When an equal number of opportunities are presented for children to use and refine text-level skills, an even greater number of children should be able to become successful readers.



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